Space Weather Technical Forecast

Issued on Thursday, 08 September 2022 at 00:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Active electron Fluence likely throughout. Slight chance of M-class flares (R1 Blackouts) throughout. Slight Chance of G1/Minor Geomagnetic Storm Day 1 (08 Sep).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Low with several very minor C-class flares observed. There are currently six sunspot regions on the visible disc, four of which are numbered. AR3096 near the northeast limb has shown growth in the last 24 hours and is now the largest region on the disc, but is magnetically simple. AR3097 has also shown some minor development. The remaining regions are all currently small and simple.
There have been no Earth directed CMEs seen in satellite imagery over the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was indicative of a slowly waning coronal hole HSS from CH20/+. Wind speeds were elevated varying between 510-600 km/s. Density was mostly average. Total interplanetary magnetic field strength, Bt, was weak at 6 nT or below. The north-south component, Bz, varied between +/-5 nT. The Phi angle was largely positive (away from the Sun). Geomagnetic activity was Quiet to Active (Kp 1-4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GEOS-16, was at background levels. The high energy electron flux (greater than 2 MeV) was at High levels, with a peak of 15,400 pfu at 07/1740 UTC. The 24-hour integrated electron fluence remained above the Active (1e8 integrated pfu) threshold on a rising trend, with 5.71e8 integrated pfu observed at 08/0000 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be largely Low, with a slight chance of becoming Moderate with isolated M-class flares, mainly from AR3096.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently expected. Solar winds continue to be elevated from the waning effects of CH20/+. Wind speeds are expected to ease somewhat over the coming days, however a weaker HSS from a faint coronal hole in the northwest may give a continuation of elevated, likely easing to slightly elevated, wind speeds through this period. Confidence in this is lower than average.
Geomagnetic activity will likely be Quiet to Active, with a slight chance of G1/Minor Storm intervals on Day 1 (08 Sep). This should slowly ease through the period to become largely Quiet to Unsettled by Day 3 (10 Sep).

Energetic Particles / Solar Radiation: High energy protons (greater than 10 MeV) are expected to remain below S1/Minor radiation storm levels. The high energy (greater than 2 MeV) electron flux is currently at High levels and are likely to remain High for much of this period, perhaps on a declining trend. However, a further rise cannot be ruled out. The corresponding 24 hour fluence is likely to remain above the Active (1e8 integrated pfu) threshold through much of this period. A declining trend is most likely, although as mentioned above a further rise cannot

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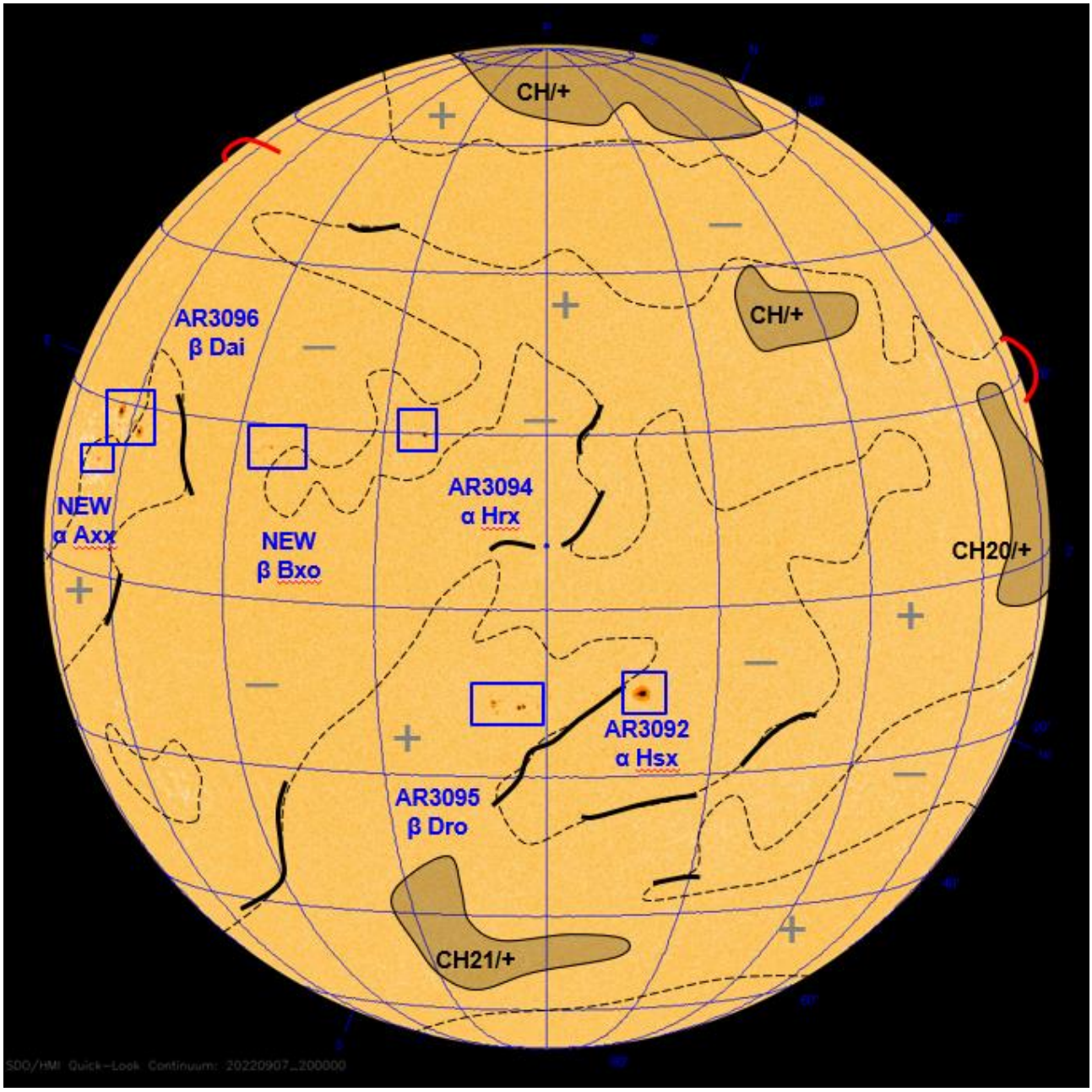
be ruled out, with just a slight chance of reaching Very Active (1e9 integrated pfu).

Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently expected.

Solar winds continue to be elevated from the waning effects of CH20/+. Wind speeds are expected to ease somewhat over the coming days, however a weaker HSS from a faint coronal hole in the northwest (evident on SDO AIA-211 imagery but not 193) may follow on from CH20. This feature may give a continuation of elevated, likely easing to slightly elevated, wind speeds through this period. Confidence on this element of the forecast is lower than average. Either way, both are positive coronal holes with the risk of a slightly more enhanced geomagnetic response at this time of year.

Geomagnetic activity will likely be Quiet to Active, with a slight chance of G1/Minor Storm intervals on Day 1 (08 Sep). This should slowly ease through the period to become largely Quiet to Unsettled by Day 3 (10 Sep).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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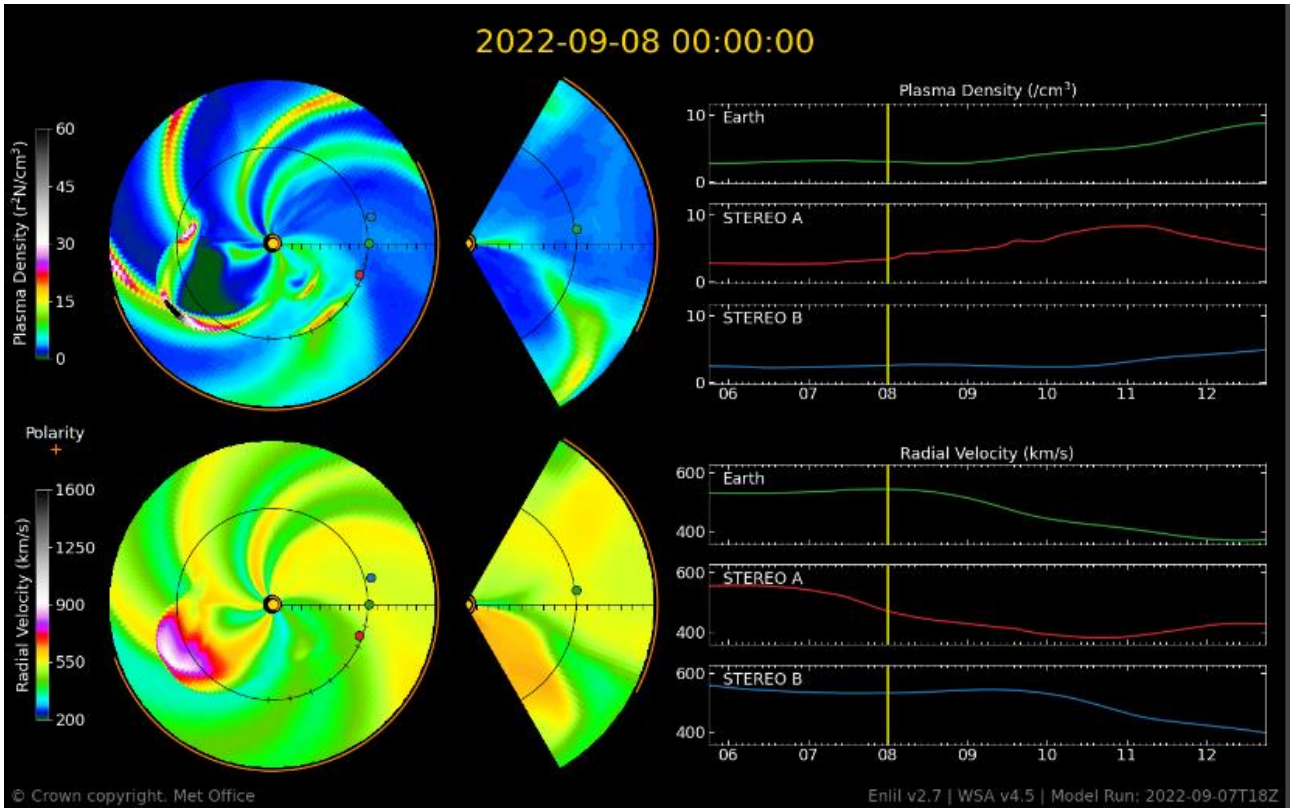
Figure 2: MOSWOC Enlil model showing a gradual decline in wind speeds in the next few days. This looks like a reasonable trend.



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Radio Blackouts - X-Ray Flares:

There are currently six sunspots on the visible disk. Solar activity is expected to be largely Low, with a slight chance of becoming Moderate with isolated M-class flares. The largest spot on the disc is now AR3096 (Dai/Beta) which has grown in the last 24 hours, however it is still magnetically simple. AR3097 (Dro/Beta) has also shown some minor growth but is also magnetically simple. All other regions are currently small and simple.

A large filament continues to be visible in the southern hemisphere, now near centre disc and will need to be monitored for any lift-off. This filament has shown some minor instability in the last 24 hours, but does not yet appear to have produced any significant activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10MeV) remains at background values. The location and lack of complexity of all current sunspots on the visible disk suggest high energy protons (greater than 10 MeV) are expected to remain below S1/Minor radiation storm levels.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	2	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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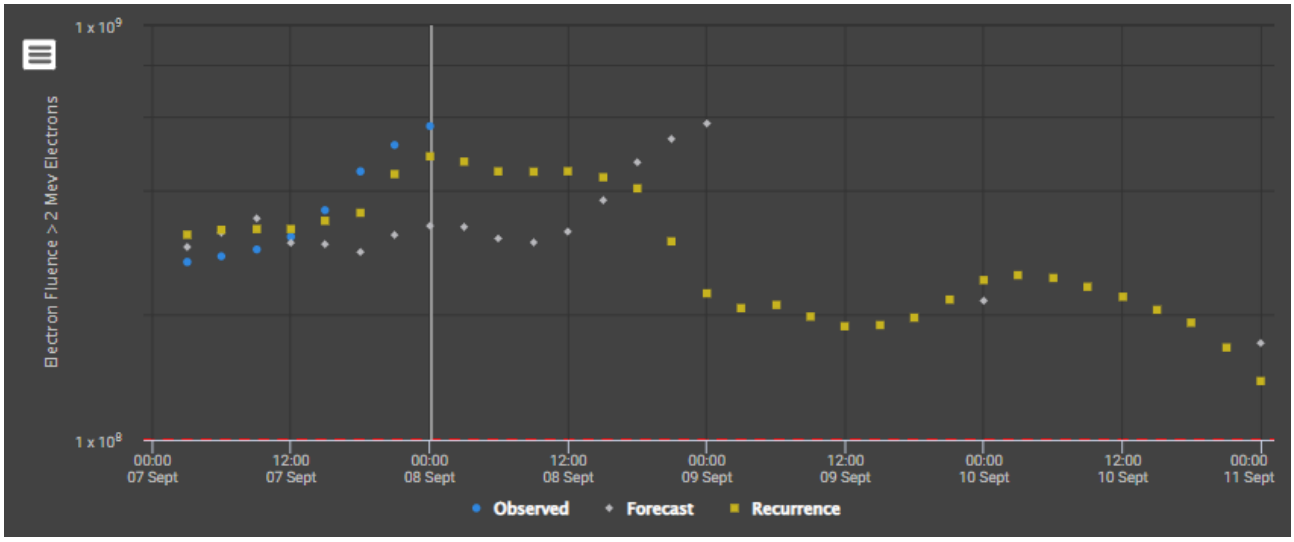
High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux is currently at High levels due to charging from the HSS from CH20. Flux levels are likely to remain High for much of this period, perhaps on a declining trend. However, as wind speeds are still elevated perhaps causing some compression of the van Allen belt, a further rise cannot be ruled out as the radiation belt fully decompresses.

The corresponding 24 hour fluence is likely to remain above the Active (1e8 integrated pfu) threshold through much of this period, which is supported by persistence. A declining trend is most likely, although as mentioned above a further rise cannot be ruled out, with just a slight chance of reaching Very Active (1e9 integrated pfu). REFM is thought to give good guidance, showing a slight declining trend above the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	90	80	60
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	10	10	5

Figure 3: MOSWOC REFM showing a slight declining fluence trend, but staying above the Active (1e8 integrated pfu) threshold. This appears to be reasonable guidance.



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